



SELF-LOCKING FEMALE RECEPTOR FOR ELECTRICAL CORD

Background of the Invention

1 This is a continuation in part of my co-pending application,  
2 Serial No. 07/911,752 filed 7/10/92,<sup>now U.S. patent No. 5,281,162</sup> which is in turn a  
3 continuation of Serial No. 07/719,930 filed 6/24/91, now U.S.  
4 Patent No. 5,129,836 issued 7/14/92.

5 Field of the Invention

6 This invention relates to electrical cords and, more  
7 specifically, to a self-locking female electrical receptor for an  
8 electrical cord.

9 Summary of the Prior Art

10 A multitude of female receptor and male plugs have been  
11 introduced in the prior art to create a connection between  
12 electrical lines. For example, it is common to use extension  
13 cords by which electrical power can be delivered to a location  
14 remote from an electrical outlet or source of electrical  
15 potential. Extension cords are often used for many tasks,  
16 including in the home, at work and other locations. A persistent  
17 problem in the use of electrical connections between plugs and  
18 receptors results from the undesired disconnection of the plug

1 from the socket during use. This can occur when an electrical  
2 device, such as a tool or other electrical equipment, must be  
3 manipulated in a fashion that the cord is pulled relative to the  
4 other cord and the plug is pulled out of its insertion in the  
5 female receptor. Such problems also exist for plugs inserted  
6 into a wall receptacle. An example of such an occurrence is  
7 present when a workman is on a roof using an electrical tool and  
8 as he operates the device, the extension cords or other lines  
9 become disconnected at a location near the ground. When such  
10 occurrences are presented, the workman must climb down the ladder  
11 and reconnect the male plug with the female receptor. Such  
12 occurrences are inconvenient, frustrating, and interfere with the  
13 productivity of the worker.

14 There have been attempts in the prior art to lock the plug  
15 into a female receptor so that a more secure electrical  
16 connection is created. Examples of prior art techniques for  
17 creating a locked relationship between male and female electric  
18 connectors are disclosed in U.S. Patent No. 2,198,504 to Poole;  
19 U.S. Patent No. 2,631,185 to Earle et al.; U.S. Patent No.  
20 2,664,734 to McEneaney; and U.S. Patent No. 4,179,175 to  
21 Farnworth et al.; and U.S. Patent No. 4,566,297 to Hawley.  
22 Although the devices in the foregoing patents disclose several  
23 techniques for creating a locking arrangement between a male plug

1 and female receptor, the locking techniques of these patents do  
2 not provide an optimumly efficient and easy to use device. The  
3 locking functions of the patents of the foregoing prior art do  
4 not provide an easy connect/disconnect to permit a user to engage  
5 and disengage the locking features by merely depressing an  
6 actuator. The prior art either requires elaborate elements to  
7 create a locking relationship, some of which are permanent in  
8 nature, or do not permit the ready disengagement as is needed in  
9 effective and efficient connection and disconnection. For these  
10 reasons, it is desirable to provide an improved electrical  
11 connection relationship between a female receptor and a male plug  
12 that is economic to manufacture, safe, and convenient to use.

### 13 Summary of the Invention

14 It is an objective of the present invention to provide an  
15 effective and economical female electrical receptor which will  
16 efficiently lock a male plug element of an electrical line, cord,  
17 or female wall receptor to prevent accidental disconnection. The  
18 female receptor of the invention is provided with locking  
19 elements that are uniquely arranged to engage the typical punched  
20 holes provided in the male prongs of an electrical plug. Without  
21 other tools, the locking elements of the invention are locked in  
22 position by depression of an exterior arranged actuator which is

1 also used to permit the plug to be easily removed. The receptor  
2 of the invention is highly efficient in use and is provided with  
3 safety features to prevent injury from shocks and the like.

#### 4 Brief Description of the Drawings

5 Fig. 1 is a side elevational view of the improved locking  
6 electrical female receptor of the invention adjacent a male  
7 electrical plug;

8 Fig. 2 is an end elevation view, with parts in section, of  
9 the female receptor of the invention of Fig. 1 taken along lines  
10 2-2;

11 Fig. 3 is an end elevational view, with parts in section, of  
12 a second embodiment of the female receptor of the invention;

13 Fig. 4 is an end elevational view, with parts and section,  
14 of a third embodiment of the locking female receptor of the  
15 invention;

16 Fig. 5 is a front elevational view of a fourth embodiment of  
17 the locking socket of the invention in the form of a wall  
18 receptor;

19 Fig. 6 is a front elevational view, with parts removed and  
20 parts in section, of the fourth embodiment of the form of Fig. 5  
21 taken along lines 6-6 of Fig. 7;

22 Fig. 7 is a top plan view, with parts removed and parts in

1 section, of the fourth embodiment of Fig. 6 taken along lines 7-7  
2 of Fig. 6;

3 Fig. 8 is a front elevational view, with parts removed and  
4 parts in section, of a fifth embodiment of the locking female  
5 socket of the invention in the form of a wall receptor taken  
6 along Figs 8-8 of Fig. 9; and

7 Fig. 9 is a top plan view, with parts removed and parts in  
8 section, of the fifth embodiment of the invention taken along  
9 lines 9-9 of Fig. 8.

#### 10 Description of the Preferred Embodiments

11 Referring now to Fig. 1, there is illustrated the general  
12 arrangement of the improved locking female receptor of the  
13 invention for electrical cords which is generally designated by  
14 reference numeral 2. Electrical female receptor 2 is connected  
15 to a typical electrical line or cord 4 having an exterior  
16 electrical insulation. The female receptor 2 is intended to be  
17 interlocked with a male plug 6 which is attached to a second  
18 electrical line or cord 8. The male plug 6 and female receptor 2  
19 can be attached to any conductive electrical lines, such as in  
20 connection with extension cords and other numerous uses well  
21 known in the art. The male plug 6 is conventionally provided  
22 with a pair of exterior prongs 10 formed from a metal conductive

1 material. Each prong 10 includes a punched hole 12, and a ground  
2 prong 14 is also affixed to the male plug 6 as is well known.

3 The female receptor 2 of the invention is formed as a molded  
4 receptor body 16 from a suitable material, such as a molded  
5 plastic and the like, that is electrically non-conductive. The  
6 end face 20 of the female receptor body 16 is provided with a  
7 pair of plug holes 22 and a grounding hole 24 that are arranged  
8 to receive respectively the prongs 10 of the male plug 6 and the  
9 grounding prong 14. The insertion of the prongs 10 and grounding  
10 prong 14 into the female receptor 2 will result in an improved  
11 electrical connection being made between the respective  
12 electrical cords 4 and 8.

13 The receptor 16 is formed with a passage 26 that extends  
14 downward into the body 16 and is in communication with the plug  
15 holes 22. A cylindrical sleeve 28 is fixedly positioned within  
16 the hole 26 of the receptor body 16 and is also formed from an  
17 electrically non-conductive material. An elongated shaft 30  
18 comprising an electrically non-conductive material, such as a  
19 plastic and the like, is movably positioned within the central  
20 passage 28' of sleeve 28. The elongated shaft 30 includes an  
21 upper portion 32 having a shoulder 32' to engage a flange 28' of  
22 the sleeve 28. An upper portion 34 of the movable shaft 30  
23 provides a manual depressible actuator situated at an accessible

1 exterior position on the body 16. An intermediate portion of the  
2 shaft 30 has a concentric area 36 having a reduced diameter and  
3 creating a profile to correspond to a spherical shape as will be  
4 apparent. The bottom portion 38 of shaft 30 is cylindrical in  
5 shape and has generally the same diameter as the internal passage  
6 28' through sleeve 28 as is best shown in Fig. 2. A pair of  
7 openings 39 in the sleeve 28 capture a pair of balls 40 for  
8 limited movement outward from the holes 39 due to the reduction  
9 of the width of the openings 39 at the peripheral surface of the  
10 sleeve 26.

11 The balls 40 are permitted movement into the narrowed down  
12 portions 36 of the shaft 30 when the portions 36 are in  
13 confronting alignment with the sleeve openings 39 and the balls  
14 40 are deflected towards the shaft 30. Such alignment occurs by  
15 depressing the upper actuator portion 34 of the shaft 30 for  
16 movement downward relative to the sleeve 26. A spring 42 insures  
17 that the plug 30 is returned to the upper position as shown in  
18 Fig. 2 when the upper portion 34 is released. It should be  
19 apparent, therefore, that the prongs 10 may be inserted into the  
20 plug openings 22 of receptor 2 when the shaft 30 is depressed for  
21 alignment of the narrowed down portion 36 with the openings 39 in  
22 sleeve 28. The plug prongs 10 therefore can deflect the balls 40  
23 inward, and entry of the prongs 10 into the receptor 2 is

1 possible.

2       The axial position of the balls 40 in the sleeve 22 is  
3 selected to correspond to the position of the prong holes 12 when  
4 the prongs 10 are fully inserted into the receptor 2. Therefore,  
5 as the upper actuator portion 34 is released, the lower portion  
6 38 of the shaft 30 pushes and biases the balls 40 outward into a  
7 locking engagement with respective prong holes 12, such that a  
8 locked connection between female receptor 2 and male plug 6 is  
9 attained. Release of the male plug can only occur by again  
10 pressing shaft 30 at upper portion 34 to align the narrowed down  
11 portion 36 of shaft 30 with the balls 40, such that the balls can  
12 easily be deflected inwardly as the prongs 10 are pulled out for  
13 removal. Since the shaft 30 and sleeves 28 are formed from an  
14 electrically non-conductive material, such as plastic, the user  
15 is not exposed to the hazards of electrical shock when  
16 manipulating the external actuator portion 34. The spherical  
17 balls 40 are formed from a suitable metal or non-metallic  
18 material and the like, such as stainless steel, aluminum,  
19 ceramic, plastic, or any material that will resist corrosion  
20 during use.

21       Referring now to Fig. 3 there is illustrated a second  
22 embodiment of the locking female receptor 2 of the invention,  
23 generally designated by reference numeral 2a. The female



1 receptor 2a includes a molded plastic body 16a having a hole 26a  
2 in which a shaft 30a extends downward. The shaft 30a is a solid,  
3 generally cylindrical plastic or any non-conductive material  
4 member, having a flared lower end 30b which is arranged to engage  
5 the pair of balls 40a provided in the female receptor body 16a as  
6 in the preceding embodiment described with reference to Fig. 2.  
7 The shaft 30a is resiliently biased upward by spring 42a. When  
8 the upper portion 34a of the shaft 30a is manually depressed, the  
9 flared bottom end 30b of the shaft 30a is oriented beneath the  
10 ball 40a to permit deflection of the balls when the plug prongs  
11 10 are inserted into receptor holes 22a. Release of the shaft  
12 30a will cause the flared end portions 30b to urge the balls 40  
13 outwardly into biased engagement with the prong holes 12 of plug  
14 6 as in the previous embodiment. Thus, to release the prongs 10  
15 from the receptor, the shaft 30a must be depressed to bring a  
16 portion of the shaft 30a having a reduced diameter adjacent to  
17 balls 40a so that the balls can easily be deflected inward and  
18 the prongs 10 released for removal of the male plug 6.

19 Referring now to Fig. 4 there is illustrated still another  
20 embodiment of the locking female receptor, generally designated  
21 by the reference numeral 2b. The embodiment of Fig. 4 also  
22 includes a molded receptor body 16b, a pair of plug prong holes  
23 22b and a receptor hole 26b for receiving a shaft 30b. The shaft

1 30b includes a cylindrical central portion extending down into  
2 the receptor in hole 26b which hole is enlarged in a central  
3 portion of the receptor 16b. The shaft is provided with an upper  
4 actuating head 50 integrally affixed to shaft 30b. A biasing  
5 spring 52 is disposed between the actuator head 50 and the  
6 receptor body 16b in surrounding relationship to the shaft 30b.  
7 The bottom of the shaft 30b is provided with a flared out portion  
8 54 having a maximum diameter at its bottom. In the position  
9 shown in Fig. 4, the flared out bottom portion 54 presses the  
10 balls 40b outward into locked relationship with the prong holes  
11 12 of the plug 6. Thus, to insert the prongs 10 into the female  
12 receptor 2b, it is necessary to depress the shaft 30b so that the  
13 flared out portion 54 moves beneath the balls 40b and the prongs  
14 can deflect the balls inward toward the reduced diameter of the  
15 shaft 30b. Upon release of the shaft 32b, the spring 52 moves  
16 the shaft 30b upward to the position shown in Fig. 4 for pressing  
17 the balls 40b into contact with the prong holes 12 in a locking  
18 relationship as in the prior embodiment. Release of the plug 6  
19 can be occasioned by depressing the shaft 32 which permits the  
20 balls 40b to be deflected in as the plug 6 is pulled out of its  
21 female receptor 2b.

22 Referring now to Figs. 4, 5, and 6 there is illustrated  
23 another embodiment of the electrical female receptor of the

1 invention in the form of a locking wall receptor 100. The  
2 locking wall receptor 100 includes a plate 102 and a socket body  
3 104. The plate 102 also includes ground holes 106 for ground  
4 prongs for receiving the ground prongs of a male plug as  
5 conventional. The plate 102 is provided with two pairs of female  
6 openings 108 to receive the prongs 110 of a typical male plug 112  
7 (Fig. 7) which is electrically connected to an electrical cord.  
8 The male plug 112 inserted in openings 108 creates an electrical  
9 connection with known conductive elements (not shown) positioned  
10 in socket body 104 and being connected to a source of alternating  
11 electrical current. Although the locking wall socket 100 is  
12 shown as having two pairs of male prong openings 108, the socket  
13 100 may include one pair or more than two pairs of prong openings  
14 108, if desired. The socket body 104 may be constructed from a  
15 non-conductive material, such as plastic and the like.

16 The receptor body 104 is provided with a pair of balls 114  
17 suitably retained in passage 116 receptor body 104 for movement  
18 laterally toward and away from prongs 110 by retention means (not  
19 shown) of similar structure as shown in the preceding  
20 embodiments. A cylindrical actuator shaft 120 having a gradually  
21 enlarged end portion 122 (Fig. 7) extends through plate 102 into  
22 position between the outside edges of the male prongs 110. A  
23 suitable spring 124 resiliently biases the actuator shaft 120

1 outward, such that the balls 114 are urged in to respective  
2 locking relationship with the punched holes 126 of the male  
3 prongs 110 of the plug 112. The actuator shaft 120 may be  
4 depressed from the outside of plate 102 during insertion of the  
5 prongs 110 of either of the two male plugs 112 being attached to  
6 create an electrical connection. By depressing the shaft 120,  
7 its reduced diameter portion 128 is positioned adjacent to balls  
8 114 to allow outward movement and clearance of balls 114, whereby  
9 the prongs 110 are easily insertable. Upon release of the  
10 actuator shaft 120 and its outward movement as provided by spring  
11 124, the enlarged end portion 122 of the actuator shaft biases  
12 the balls 114 into contact with prong holes 126 to lock either  
13 one or both of the inserted plugs 112. To release the plugs 112,  
14 the actuator shaft 120 may simply be depressed. A pair of  
15 auxiliary balls 130 are mounted in body 104 and are resiliently  
16 biased laterally by spring 130 into a respective outer prong hole  
17 126 to aid in retention of the respective male plug 112.

18 Referring to Figs. 7 and 8, there is illustrated still  
19 another embodiment of the electrical female socket of the  
20 invention in the form of a locking wall receptor 150. The  
21 locking wall receptor 150 includes a wall plate 152 and a socket  
22 body 154 formed of a non-conductive material. The plate 152 is  
23 provided with two pairs of opening 158 to receive the prongs 160

1 of a typical male plug 162 connected to an electrical cord (not  
2 shown). Electrical contacts (not shown) coupled to a source of  
3 electrical alternating current is mounted in socket body 154 and  
4 is intended to be in contact with the prongs 160. Although the  
5 locking wall receptor 150 is shown having two pairs of prong  
6 openings 158, the receptor 150 may include one pair or more than  
7 two pairs of prong openings 158.

8 The socket body 154 captures a pair of balls 164 in the  
9 preceding embodiments to engage the openings 166 of a male prongs  
10 160 of a plug 161. Each of the balls 164 is biased by one of a  
11 pair of actuator shafts 168 each positioned in parallel relation  
12 to one of the prongs 160 and having an enlarged end portion 170.  
13 A pair of springs 172 respectively bias both actuator shafts 168  
14 outward to cause the enlarged end portions 170 to deflect the  
15 balls 164 to engage the holes 166 of prongs 160. To insert or  
16 release a respective male plug 162, the actuator shafts 168 are  
17 depressed to position a narrow portion 170 of the actuator shaft  
18 168 adjacent a ball 164 to allow release. A pair of auxiliary  
19 balls 180 are also resiliently biased by spring 182 into the  
20 other hole 166 of male prong 160 in the inserted position of a  
21 plug as described with reference to Figs. 5 to 7.

22 In the foregoing embodiments of the invention, it should be  
23 apparent that the male plug is retained in a locked position in

1 the female receptor or socket and can be released by a convenient  
2 actuator positioned exteriorly of the receptor or socket. The  
3 invention in the application provides an economical device that  
4 is easy to use and effective in maintaining a locked relationship  
5 between electrical cords and wall outlets for both reasons of  
6 convenience and safety.